

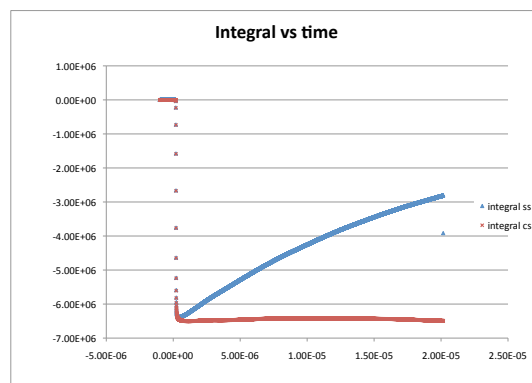
May 10 2010 S. Pordes

A way to treat the positive overshoot of an AC coupled photomultiplier pulse that is being sampled with a time bin which is small compared to the time constant of the overshoot is to use an IR filter to calculate the baseline and subtract the measured signal from the calculated baseline. The equation for the baseline is

$y'_i = \beta y'_{i-1} - (1 - \beta)x_{i-1}$ where the two terms correspond to the decay to zero of the baseline offset due to previous pulses and a further excursion due to a present pulse.

y'_j is the baseline of interval j , x_j is the true value of the signal and $\beta = e^{-\delta/\tau}$ where δ is the bin interval and τ is the time constant. Since we don't actually know what x is, it is more convenient to rewrite this in terms of y the actual value of the ADC. $x = y - y'$ and hence $y = x + y'$. A little manipulation gives $y'_i = y'_{i-1} - (e^{\delta/\tau} - 1) \times y_{i-1}$.

I have tried this on Ben's average laser pulse where the sampling is 4 ns. In the figure the blue is the pulse integral (ie volts-seconds) calculated from a constant baseline (the value of the ADC just before the pulse). In red is the value of the integral using the baseline correction where I have used a time constant of 25 microseconds. Note that this make $\delta/\tau = 1.6 \times 10^{-4}$, plenty small. This approach seems to have some promise. It will be interesting to see how it works on non-averaged (real) pulses, of course.



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